Digital Transformation Insights and Trends

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Abstract. *Digital transformation (DT) is an emerging paradigm, which introduces strategy-oriented and customer-centric changes in infrastructure and processes in modern organizations relying on contemporary information and communication technologies (ICT). Transforming in DT is not a one-time process, it is a holistic approach of shifting organizations towards implementation of new methods for raising organizational performances by boosting the organizational capabilities and competitiveness, creating thereby new models of doing business. This paper provides an insight into digital transformation in the form of an overview for the purpose of defining digital transformation and identifies its drivers. A brief bibliographic analysis of available literature is presented. Key determinants of digital transformation are defined and an overview of the methodologies used to assess the digital maturity of enterprises is made. Contextual influence factors and examples of enablers of digital transformation were discussed and existing trends and technologies in this challenging and promising field are positioned.*

Keywords. digital transformation, literature insights, key determinants, digital maturity, future trends.

1 Introduction

Digital transformation of enterprises is a new paradigm in the context of implementing contemporary technologies to set new products and services and change the mind-set of delivering them to the global market. It is defined as "the profound transformation of business and organizational activities, processes, competencies and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way, with present and future shifts in mind." [i-SCOOP.eu, 2016].

All digital changes in organizations can be grouped into one of the three categories [Westerman et al, 2014, pp 108]:

1. **Substitution**, where digital technologies are used to replace a function/process that is already performed in the organization;
2. **Extension**, where digital technologies are used to improve the functionality of a process/product; and
3. **Transformation**, where digital technologies are used to fundamentally redefine a process/product.

Digitization has not penetrated yet equally in all industries, but it has begun to transform many of them, and it has a significant impact on the economic performance of companies within those industries. As the growth continues, the implications for revenues, profits, and opportunities will be dramatic [Bughin et al, 2018, pp 2].

While identifying the main drivers of digital transformation, we came across several statements that might sound superfluous but, in our experience, depict well what is being put in front businesses as demands from the market or as requests from customers:

- Customer expectations continue to rise [Tiersky, 2017]
- SPEED is more important than ever [Tiersky, 2017]
- Digital transformation means business transformation [Tiersky, 2017]
- Unlocking Data Silos [Candito, 2017]
- Information "On the Go" [Candito, 2017]
- Intelligent Work Processes [Candito, 2017]
- Innovate or Die [Innovate or die, 2018]
- Everyone is doing it [Roche, 2018]
- With enormous change comes opportunity [Roche, 2018]
- At the heart of the change is reducing costs and driving greater efficiencies [Roche, 2018]

With aim to explore the developments in this area, researches were conducted and insights provided into the field of digital transformation as part of the research project (IRI) *Development of innovative*

platform for digital transformation of enterprises. Following analyses were made:

- **literature analysis on digital transformation**, including the analysis of existing scientific databases, journals, papers and areas or activities pertinent to digital transformation (as explained in chapter 2);
- **key determinants of digital transformation**, focusing on industrial areas and contextual factors which contribute to technological improvements with the purpose of digital transformation of organizations (as explained in chapter 3);
- **methodologies of assessing digital maturity of enterprises**, which influences and enables digital transformation of businesses (as explained in chapter 4);
- **contextual influence factors and examples of enablers** in the context of digital transformation (as explained in chapter 5);
- **new trends and technologies** in the field of digital transformation (chapter 6).

The following chapters present insights into and trends in digital transformation.

2 Literature analysis on digital transformation

With the aim to obtain some insights into this research field, the literature was collected from Scopus as one of the most relevant and high-quality scientific databases of scientific papers in this field. Regardless of the limitations, as this literature review cannot be considered as exhaustive, it does give a valuable insight into digital transformation. The search of data was conducted on 15th March 2018, based on keyword "digital transformation" in the contribution title, and it resulted in 154 hits. (Databases like Scopus index papers all the time, from 1-3 years back so they are not stochastic!).

The papers were reviewed by the year of their publication. It was established that the term „digital transformation" in the present-day organizational and ICT sense was first defined and used between 2000 and 2003. The following years saw an increase in the amount of works dedicated to this field, which culminated in 2016, remaining high in 2017 as well as in first months of 2018. Fig. 1 shows the number of works in Scopus database published from 2000 to date.

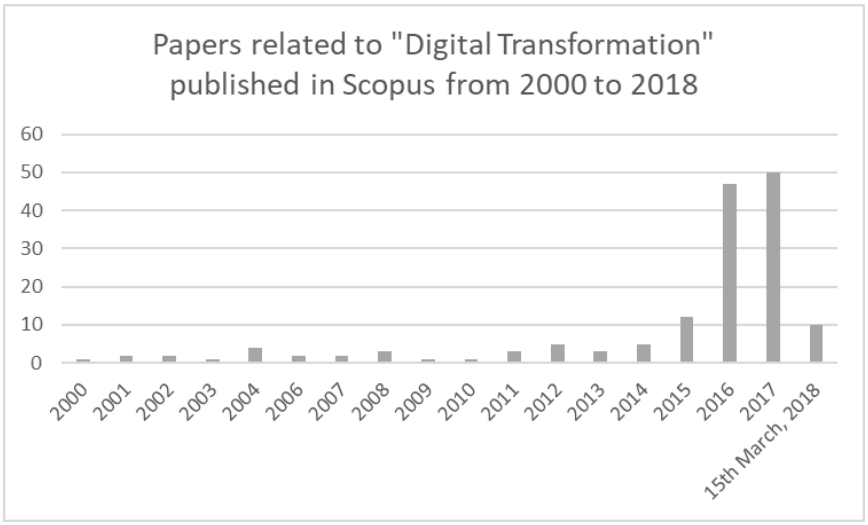

Figure 1. Works in Scopus database using term "digital transformation" from 2000 to 2018

The chart presented above shows that the number of works has significantly increased over the past three years with a tendency of further growth in 2018, given that only those published in the first quarter of the year have been indexed so far. The number of indexed works is typically higher in the second half of the year due to slower pace of indexation and publication of scientific papers. The works published before 2000 have not been taken into account because "digital transformation" mentioned there refers to the digitalization of pictures and texts from analogue media and not to the meaning of the term in the modern sense.

As regards the publication fields, the titles listed in Scopus database are found in a variety of fields of human activities. As for scientific fields, we find them, quite understandably in information/computer science, but also in all other fields of human activities, especially in business, management, accounting, engineering, social sciences, decision science, economics and finance, medicine, protection of environment, etc. Fig. 2 provides an overview of the number of works by industry, where a single paper may be listed in several fields.

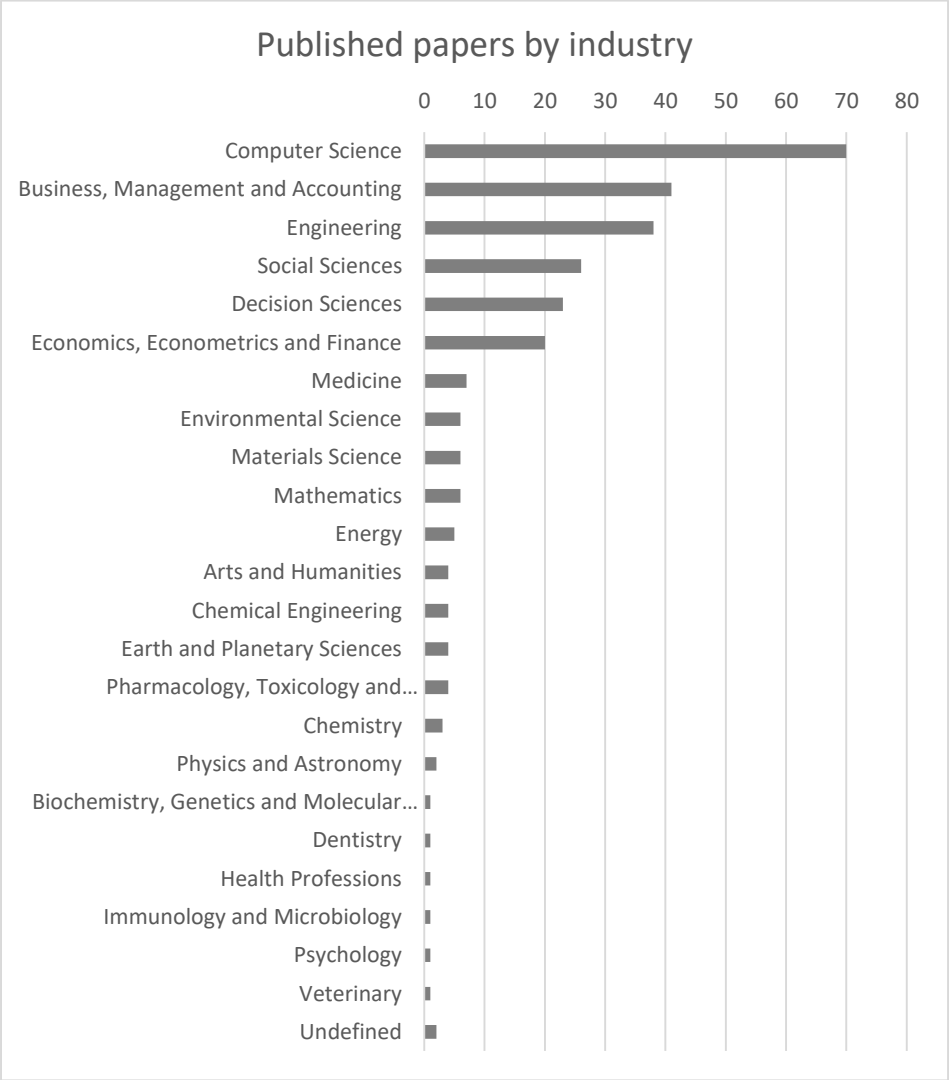

Figure 2. Published papers by industry

Judging by the number of citations, the titles listed below can be considered as the most important in the field of DT:

1. The digital transformation of traditional businesses, authored by Andal-Ancion, A., Cartwright, P.A., Yip, G.S. from 2003, which defines in detail this field from the scratch; it was published in the MIT Sloan Management Review 44(4), pp. 34-41 and was cited 55 times [Andal-Anction, Cartwright & Yip, 2003].
2. Innovation diffusion in global contexts: Determinants of post-adoption digital transformation of European companies, authored by Zhu, K., Dong, S., Xu, S.X. and Kraemer, K.L. from 2006. It was published in the European Journal of Information Systems. 15(6), pp. 601-616, and cited 182 times [Zhu et al., 2006].
3. Digital transformation: Opportunities to create new business models, authored by Berman, S.J. from 2012, published in the Strategy and Leadership 40(2), pp. 16-24, cited 35 times [Berman, 2012].

These papers constituted the cornerstone of all relevant researches in the field over the past three years and, at the same time, provide initial framework of what we today call "digital transformation".

3 Key determinants of digital transformation

The analysis of identified scopes, pillars and areas of methodologies used to assess DT made it possible to identify the convergence by key determinants of digital maturity:

a) **Strategy orientation –** vision, management, leadership
b) **Customer centricity** – monitoring of customers' experiences, prediction of their needs

c) **ICT and process infrastructure** – ICT resources, management of business processes
d) **Talent, capability and capacity strengthening** – culture of permanent investment in new skills, knowledge and capacities
e) **Innovation culture and organizational commitment** – commitment to organizational culture, innovation culture and organizational factors.

A more detailed analysis of expert reports and scientific literature and a closer insight into the features of each methodology made it possible to classify both those methodologies and the models created therefrom, by several criteria:

1. **According to the stage of the assessment methodology implementation,** to those that are implemented:
   a) *Only initially, at the beginning of the DT project* for the purpose of establishing initial state of affairs;
   b) *Both before and after digital* transformation in order to establish the initial state and measure effects, i.e. improvement;
   c) *Only at the end of the DT* project for the purpose of assessing new positions.
2. **With regard to the inclusion of technological** support, some methodologies entail:
   a) *Technological approach*, which refers to IT solutions that facilitate self-assessment by means of web applications, online questionnaires and similar platforms, or
   b) *Personalized approach* with a high level of consultant engagement in detailed assessment.
3. **According to applicability of maturity assessment methodology** in the domain of related industry:
   a) *Specialized methodologies* for maturity assessment applied to specific industries
   b) *General methodologies* for maturity assessment.

Given the key determinants of digital transformation, the conclusion is that organizations are expected to be agile. Agility refers to the set of properties required in every modern organization to enable them not only to respond to the challenges of the market but also to create new products and services as well as to create demands for them. These properties include changing environment adaptability, organizational flexibility oriented towards team work and project-type approach, high collaboration skills, evolutivity in the realization of business processes and incremental approach to the delivery of products and services.

Agility is today hard to master without proper support based on contemporary and emerging technologies which, however, should not be the starting point in creating development plans, but rather the means of its realization.

Thus, taking into consideration basic categories of digital transformation associated with the strategy orientation and focused on the customer/user, monitoring of customers' experiences, prediction of customers' needs, different technologies may have different impacts on organizations in different industries.

Some technologies involve minimum standards of survival and competitiveness (mainstream technologies), whereas some others enable industries to make a strategic step forward in relation to their competition in the market and contribute to achieving strategic advantages over their competition.

4 Methodologies of assessing digital maturity of enterprises

The paradigm of "digital transformation" gave rise to the need for organized approaches to its implementation. In order to analyse possible effects of investments into digital transformation, which is a reasonable thing to do, various methodologies of assessing digital maturity of organizations have been developed. They are supposed to be implemented in the digital transformation projects with the purpose to measure the effects of transformation.

Some examples that illustrate the types of digital maturity assessment were selected from the wide range of global and regional methodologies:

1. **Digital Maturity Model** - TM Forum (three key elements) [TM Forum, 2018].
2. **Digital Maturity Model 5.0** – Forrester (four dimensions) [Forrester, 2018].
3. **Digital Maturity Assessment Tool** - Government of South Australia [Government of South Australia, 2015]
4. **Key pillars of digital transformation** - Chief information Officer (CIO) Report (key pillars). [Evans, 2017]
5. **Framework for digital maturity of schools** – CARNet (five areas) - regional model intended for the eduational sector and developed as part of the project "e-Škole: Uspostava sustava razvoja digitalno zrelih škola (pilot projekt)" /e-Schools: Creation of the system of digitally mature schools (pilot project/ [e-Škole, 2018]

Key pillars, categories, i.e. dimensions of the selected methodologies for assessing digital maturity are given in Table 1.

Table 1: Pillars, categories and dimensions of the maturity assessment technologies

Digital Maturity Model – TM Forum (three key elements)	Digital Maturity model 5.0. - Forrester (four dimensions)	Digital Maturity Assessment Tool Government of South Australia – (five pillars)	Key pillars of digital transformation – CIO (key pillars)	Framework for digital maturity of schools – CARNet (5 areas)
Customer centricity	Culture	Governance and leadership	Strategy and vision	Planning, management and leadership
Organization and Culture	Organization	People and culture	People and culture	ICT in learning and teaching
IT and software skills	Technology	Capacity and capability	Process and governance	Development of digital competences
	Insights	Innovation	Technology and capabilities	ICT culture
		Technology		ICT infrastructure

5 Contextual influence factors and examples of enablers of digital transformation

In the course of activities conducted in previous researches, an analysis of the implementation of social platforms and media as technology-based concepts of the process enhancement was done. Relevant scientific sources were examined, scientific papers collected, and an extensive analysis of their contents was conducted. The existing models of similar researches were used as a setting for our research [Niehaves & Plattfaut, 2011]. The incidence of classification and identification of particular properties is described in the research work [Suša Vugec, Tomičić-Pupek & Bosilj Vukšić, 2018]. The authors show that, in terms of structural dimensions, the advanced technologies of the social BPM are equally applied both to build and to use the new systems. They also show that, in terms of the process dimension, the most dominant are the initiatives aimed at improving the collaboration inside the organization and the collaboration with users/customers. As for the dimension of the contents of initiatives, new systems are most often implemented with the purpose of restructuring or enhancing business processes as part of continuous management of organizational performance.

As reported, the properties incidence in the examined literature covering case studies shows that organizations pursue initiatives to introduce agility based on the following indications:

a) The initiative is focused on building a system that will be intensely exploited;
b) The initiative is focused mainly on the management and the employees in the company and, to a lesser extent, on the need to communicate with customers.
c) The initiative is focused on improvement of the collaboration within the organization and with customers, and on better distribution of tasks and roles within the process, and
d) On enhancement and restructuring, permanent management of processes and knowledge.

The results of the conducted research, published in [Suša Vugec, Tomičić-Pupek & Bosilj Vukšić, 2018], confirm previously obtained results [Niehaves & Plattfaut, 2011]. This indicates consistency of the research framework which can therefore be used to research the implementation of other technologies as well.

These initiatives for introducing agility in doing business are influencing organization's choice of suitable technologies for improving their processes and further development of an agile business architecture [Meffert, Breuer, Evers, 2018]. Improvements can be related to increasement of efficiency or effectiveness, development of ecosystems of businesses, increase of agility in order to react on disruptions of regular business models before the competitors do, creating new markets, products or services, managing customer journey and experience and other challenging issues [Pejić Bach, Spremić & Suša Vugec, 2017, Dhawan et al, 2018]. The improvement initiative is the context of designing and introducing often a mix of suitable technologies for supporting processes engaged in the digital transformation. Various technologies are being related to digital transformation like mobile and cloud technologies, social platforms, big data and Data analytics, Internet of Things, Virtual and Augmented Reality, Drones, Robotics and autonomous systems, 3D printing, blockchain, Artificial Intelligence, Reference models, knowledge management and other all oriented towards making the organization "future-ready" [Ross, 2018; Weill & Woerner, 2018]. All these new digital technologies have been developed independently of one another and independently from the trend of digital transformation, but they all can be

used simultaneously to digitally transform organization's business processes. Technologies are not all suitable for all organizations, therefore improvement initiatives as well as legacy technologies are the contextual influence factors and enablers of DT. While some of the mentioned technologies have an emerging significance in some industries, the same technology can already be mainstream for some other industry, like VR or autonomous systems that are already mainstream in the automotive industry can be seen as emerging technologies in agriculture.

6 New trends and technologies in the field of digital transformation

New development trends involve implementation of new digital technologies under the common name of Industry 4.0 or Fourth Industrial Revolution.

Thereby "the rate of the technological development in Industry 4.0 is exponential and, therefore, anticipating the challenges and even the benefits is much more difficult than what the world experienced in the previous industrial revolutions. This increased difficulty is due to the high convergence of technologies that could complement or compete with different possible diffusion scenarios that may result in more frequent breakthroughs that are difficult to forecast." [Morrar, Arman & Mousa, 2017]

IoT (Internet of Things), virtual and expanded reality, robotics, autonomous systems, mobile technology, blockchain and technologies in the field of social media and platforms have *de facto* become standards in some industries (e.g. automobile manufacturing industry, software industry, creative industries, and industries linked with financial institutions).

Schwab [2017] made a list of emerging technologies (presented as results of a survey, conducted in September 2015 by the World Economic Forum's Global Agenda Council), with their positive and negative impacts. A selection of those technologies is shown in Table 2:

Table 2: Emerging trends in digital transformation

Technology	Description	Positive impacts	Negative impacts
Implantable technologies	Devices implemented into bodies, from pacemakers, and smart tattoos to „built-in" smartphones	Beneficial to health monitoring or locating missing children	Threat to privacy and data security
Wearable Internet	Technologies in mobile phones designed to fit in clothes and accessories	Self-sufficiency and better decision making	Threat to privacy and data security, addiction
Internet of things	Connecting to „everything" on the Internet via sensors and appropriate applications	Rise in productivity, improved quality of life, safety (of food, planes…), creation of new businesses, connection with environment	Privacy concerns, loss of traditional jobs, security threats
Smart cities	Management of energy, material flows, logistics and traffic through sensors and data platforms	Rise in productivity, improved quality of life, lower rate of crime, increased mobility, better access to education	Privacy concerns, risk of system collapse, cyber-attacks
Big data	Management and use of huge amounts of data in automated decision making and real-time services customization	Better and faster decision making, cost savings, new job categories	Job losses, privacy concerns, questionable trust in data, questionable ownership of data
Driverless cars	Cars started and driven by means of built-in applications	Improved safety, lesser impacts on environment, improved mobility for the old and disabled	Job losses, cyber-attacks, lower revenue for public transportation
Robotics	Design, construction, operation, and application of robots	Substitution to people's hard work	Job losses, liability and accountability
Blockchain	Distributed trust mechanism designed to keep track of transactions	Disintermediation of financial institutions explosion of tradable assets, increased transparency	Trust of people, fear of losing financial reality

Sharing economy	Exchange of physical goods, assets or services	Increased access to resources, better asset utilization	More contract labour, decrease of grey economy, abuse of trust
3D printing	Creation of a physical object by printing it layer by layer from a drawing or model	Accelerated product development, rising demand for product designers, more personalized products	Job losses, piracy, uncontrolled production of body parts, opportunity for printing objects with high level of abuse like guns

All listed technologies have a potential to increase productivity and bring digital transformation into an organization, **either introduced or used separately**, or as a combination of both, the only challenge being the right choice.

As stated by Westerman et al.: "New digital technologies can fuel innovation and improve company performance, but only if applied in the right places" [Westerman et al, 2014, pp 36].

Digital transformation methodological guidelines such as The digital transformation compass [Westerman, et al, 2014, pp 174], Business model canvas [Osterwalder et al., 2014, pp 16] or the Digital transformation framework [Matt et al, 2015, pp 342] should help businesses to digitally change their work and/or the results thereof by leading them through the transformation. The start of the transformation depends on defined strategic goals: if the goal is driving new digital revenue, then the start should be with strengthening the digital content – the what is consumed; if the goal is cross-selling and driving more revenue per customer, the focus should be on improving customer experience – the how it is packaged; if the goal is efficiency and flexibility, then focus is to be made on building and exploiting shared digital platforms – the how it is delivered [Weill & Woerner, 2013, 73].

8 Conclusion

This paper provides an insight into the field of digital transformation and an explicit description of its key determinants and trends. A bibliographic analysis of the relevant works was done in this field through investigation of 154 papers from the Scopus database. The purpose was to show the trends and relevance of digital transformation and prove it to be a novelty in the ICT implementation approaches. Having reviewed the literature, the frequency of published works per industries was presented so as to show that digital transformation is not just a matter of technology and information science, but also that it is happening in all organizations, regardless of their form or type of business processes.

Defining key determinants of digital transformation and reviewing of the methods of assessing digital maturity of organizations made it possible to identify the existing methods. The paper describes methods and techniques available to any and all organizations which are required to identify, describe and classify their current state or key factors and, based on the findings, take a set of steps forward and move to a higher level of maturity and carry out digital transformation of business processes.

Set of contextual influence factors were defined and examples of enablers impacting the management of business processes in order to try to achieve organizational restructuring and eventual digital transformation are described. At closing, a presentation is provided of the present-day trends and technologies related to this field, the impacts of which and their interconnection allow for unique combinations of organizational and technological achievements, which in turn lead to the creation of new models of business practice by creating added value in, sometimes, most unexpected places.

In conclusion, we can only say that digital transformation through strategy-oriented and customer-centric changes in infrastructure and processes in modern organizations relying on contemporary information and communication technologies, is likely to ignite innovations and enhance performance only if "applied in the right places, as stated by [Westerman et al, 2014, pp 3]. This, however, requires a shift in mind-sets on the part of the people in whose organizations digital transformation is to be made.

Acknowledgments

This research has been conducted as part of the wider research in the project Development of innovative platform for digital transformation of enterprises (RDI) which is funded by European Union through the European Regional Development Fund (ERDF).

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